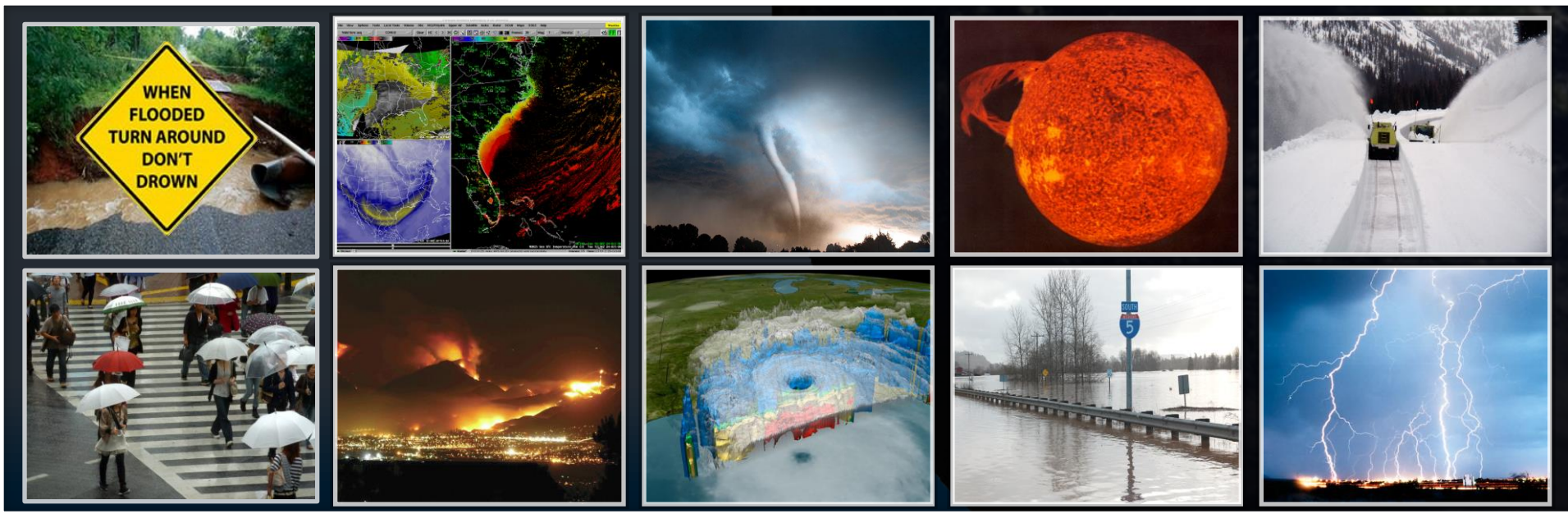
Building a Weather-Ready Nation

Central Processing

January 14, 2016 • New Orleans, LA



Central Processing Portfolio
Benefits and Scope

Central Processing Portfolio Benefits

Ensures uninterrupted flow of information from collection of observations to central guidance production to local applications of all essential weather and climate data products and continuity of public watches and warnings

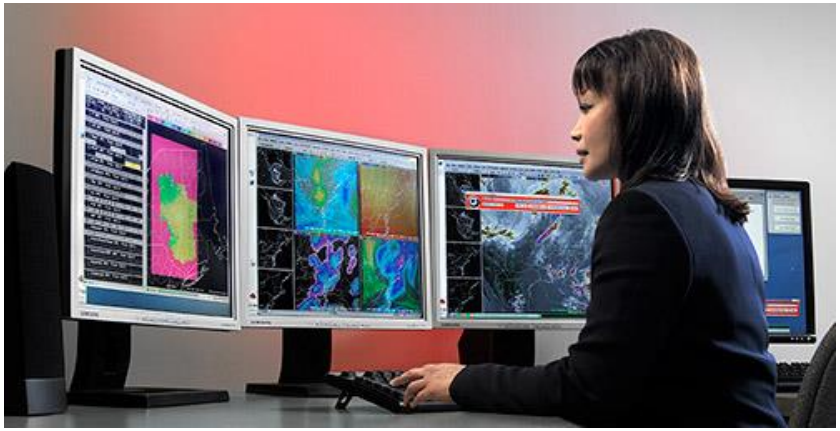
Central Processing Portfolio Scope

- Operate NWS' IT processing infrastructure
- Identify NWS' processing requirements and gaps
- Review NWS' processing system capabilities
- Seek solutions to fulfill NWS processing requirements
- Develop a strategy to maximize effectiveness while minimizing cost
- Coordinate NWS' processing system activities across NOAA
- Maintain a 24/7 help desk for all forecast systems

Central Processing Portfolio
Activities

Weather and Climate Operational Supercomputing System (WCOSS)

- 24x7 weather and climate forecasting capabilities
- Highly available, geographically separate primary and backup operational supercomputing systems
- Development supercomputing capability including resources for NOAA HFIP activity
- Associated storage resources, wide area network, and support services
- Numerical environmental prediction model development and testing



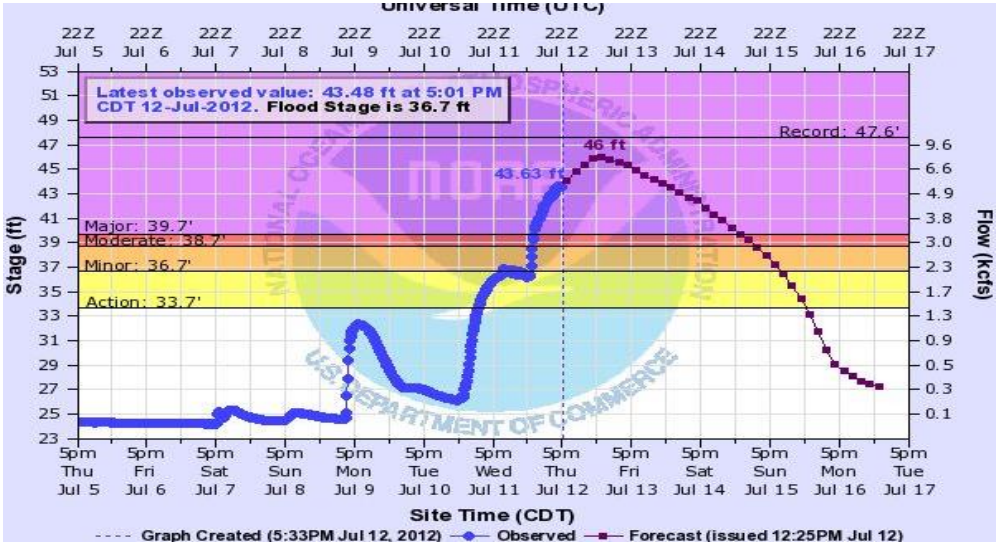
Advanced Weather Interactive Processing System (AWIPS)

- Integration and display of meteorological and hydrological data, satellite, and radar data at NWS field offices
- Acquires and processes data from sensors and local sources
- Computational and display functionality at operational sites
- Interactive communications system to interconnect NWS operational sites
- Initiates weather and flood warnings and forecasts in a rapid and highly reliable manner
- Communication interface to much of NOAA's real-time environmental data for internal and external users

Central Processing Portfolio
Activities

National Centers for Environmental Prediction (NCEP) Central Operations (NCO)

- 24x7 monitoring of NCEP Production suite
- 24x7 system maintenance and administration service
- Transition models into operations
- Quality assurance of observations and products
- Software development for data processing, display, interaction, and product generation
- Supports on-demand requirements including dispersion forecasts
- Deploys and supports centralized dissemination systems for the Integrated Dissemination Program



Hydrology Information Technology (IT)

- Advanced Hydrologic Prediction System (AHPS)
- Web-based suite of river-forecast products
- Expansion of advanced river forecast information to 4,011 locations throughout the United States by 2017
- Community Hydrologic Prediction System (CHPS)
- IT infrastructure enabling access to hydrologic models at all 13 River Forecast Centers

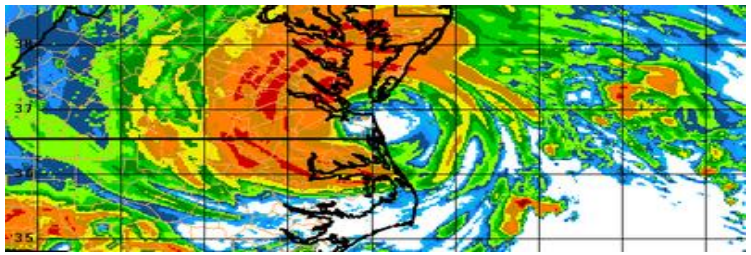
National Centers and Regional IT Infrastructure

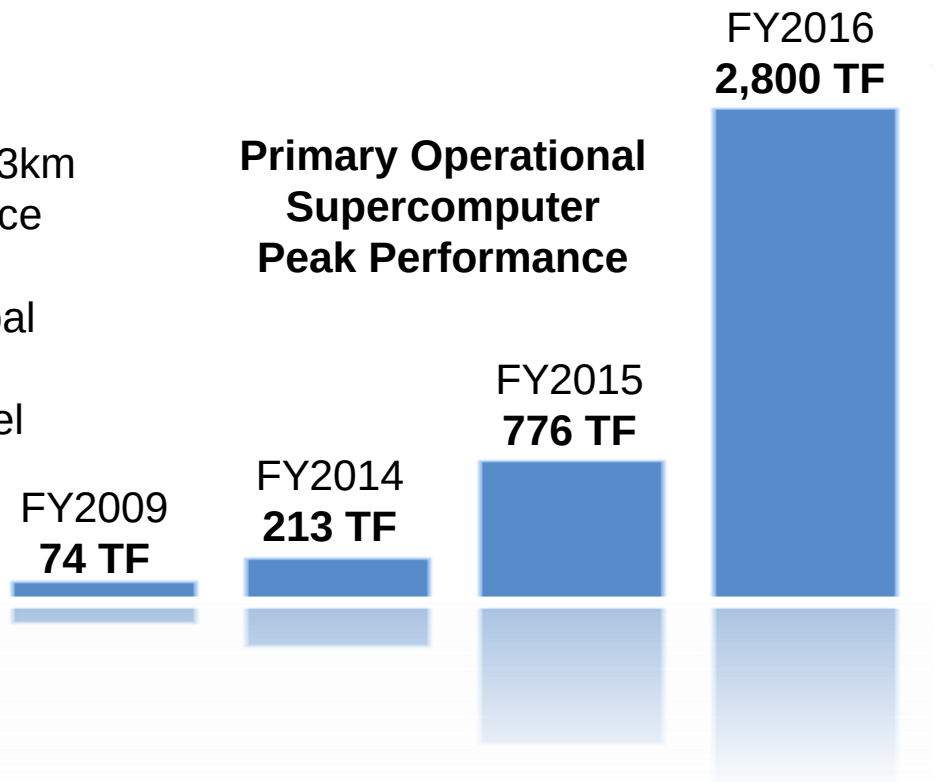
- Maintenance of IT infrastructure and standards to enable National Centers and regional offices, including forecast offices to effectively work together
- Computing that occurs outside of AWIPS
- Local area networking
- IT Security
- Data center power and cooling

Central Processing Portfolio
Operational Supercomputer Upgrades

Model Implementations

- ✓ **January 2015** – Increase resolution of Global Forecast System to 13km out to 10 days
- ✓ **June 2015** – Increase HWRF resolution from 3km to 2km with expanded capability to run guidance for tropical cyclones globally
- ✓ **December 2015** – Increase resolution of Global Ensemble Forecast System and increase resolution of output of 0.5 degrees for all model times





Operational Supercomputer
NWC Entry into Supercomputing

Springfield, Missouri

Integrated Water Prediction: Forecasts for every stream reach (2.7 million across U.S.)

Current NWS Hydro Forecast Point
James River at Galena, MO
(40 miles downstream)

150 km

Hospitals EMS Fire

Infrastructure Data from National Geospatial Intelligence Agency

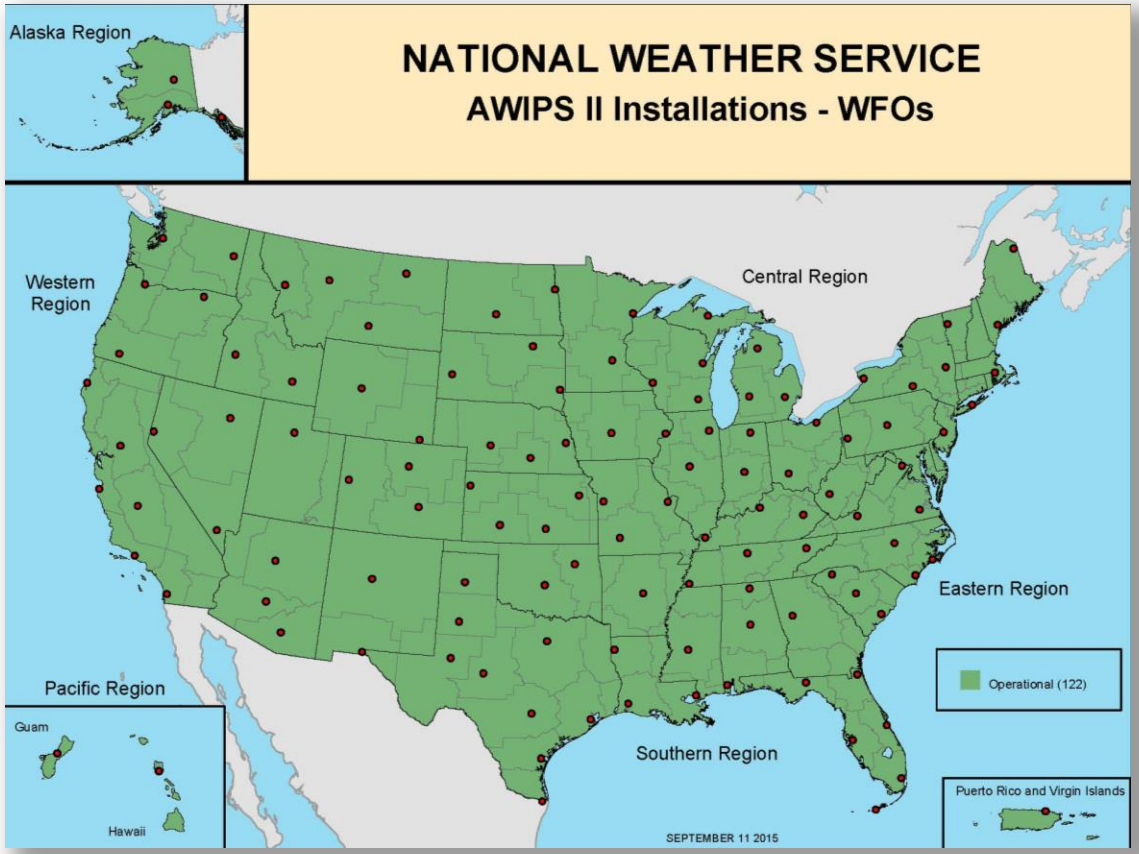
Central Processing Portfolio
AWIPS

AWIPS-2 Deployment

- Completed in September 2015
- Enhancements leveraging AWIPS II capabilities

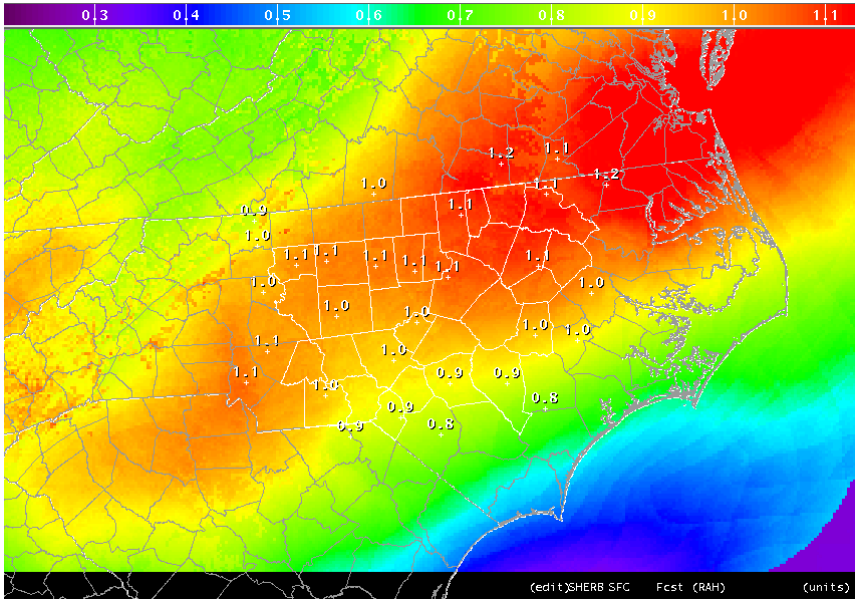
AWIPS Re-compete

- Request for Proposals released August 2015
- Proposals received October 2015

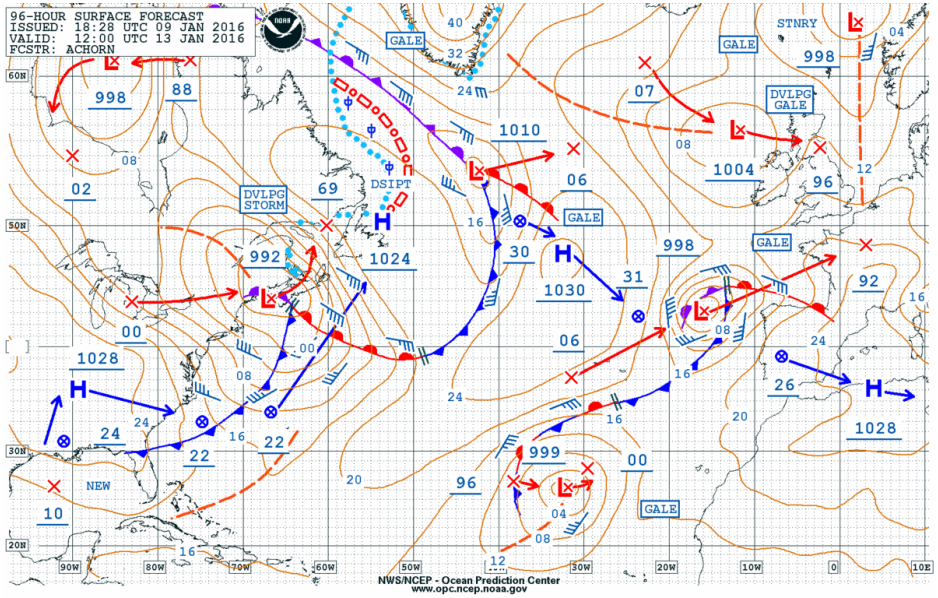


AWIPS
N-AWIPS Migration

- Migration underway of the National Center's AWIPS (N-AWIPS) capabilities into AWIPS II
- Integrates capabilities between field and national offices leading to more efficient services and consolidation of hardware and software baselines



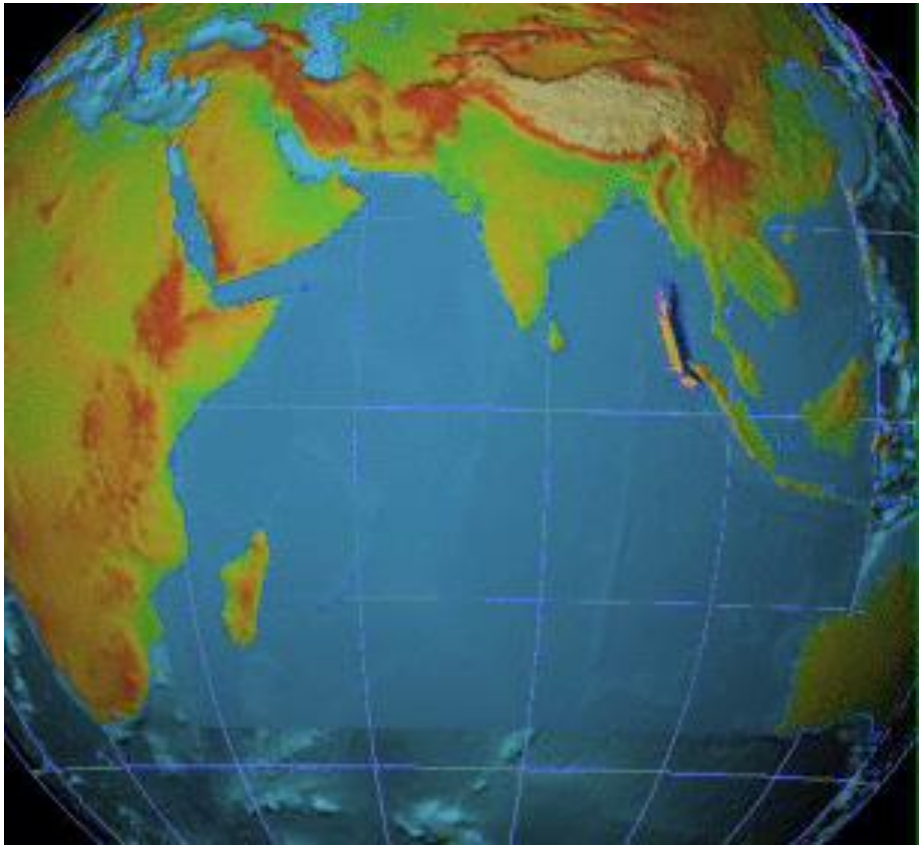
Local WFO Perspective



National Center's Perspective

AWIPS
Tsunami IT Modernization

Developing Tsunami Warning Center Operations System (TOPS) within AWIPS to enable a common IT architecture, software, and hardware approach across both centers.



Pacific Tsunami Warning Center (PTWC) at Ford Island, Hawaii

National Tsunami Warning Center (NTWC) at Palmer, Alaska

AWIPS
Broadcast Message Handler

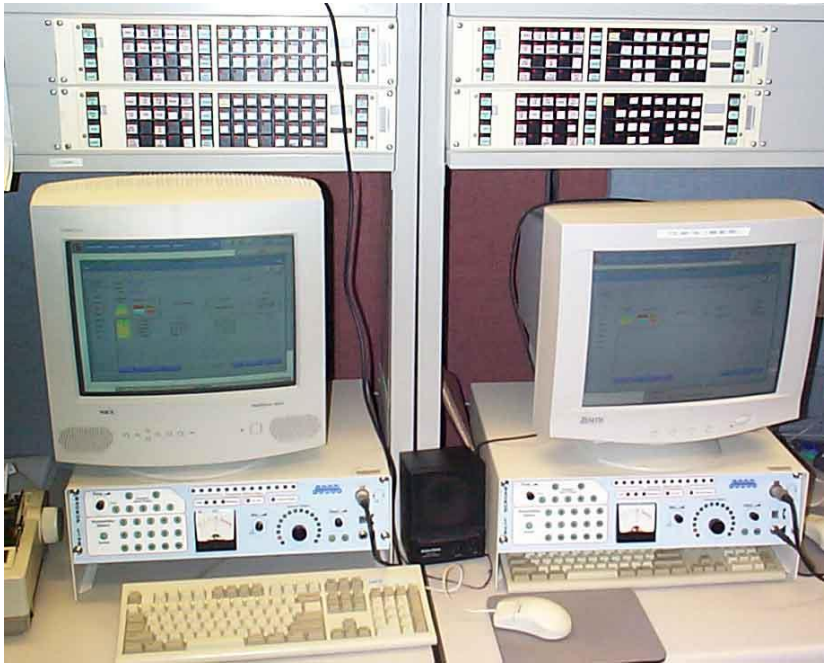
Migration of NOAA Weather Radio Console Replacement System functionality into AWIPS II infrastructure

Software Development:
- April 2014 - January, 2015

System Testing:
- January – September 2015

Operational Test and Evaluation:
- October 2015 – January 2016

Begin Deployment:
- February 2016



All Hazards NOAA Weather Radio
NOAA's National Weather Service

Central Processing Portfolio
Strategic Plan - DATA

AMERICA IS OPEN FOR BUSINESS

Department of Commerce Strategic Plan 2014-2018

DATA GOAL

- Transform the Department's data capacity to enhance the value, accessibility and usability of Commerce data for government, business and the public

  NOAA Big Data Project

- Collaborate with the business community to provide more timely, accurate, and relevant data products and services for customers

  NWS Open Model Data Initiative

Central Processing Portfolio
NOAA Big Data Project

Research through Data Alliances

Collaborators established in April 2015 as nucleus around which data marketplaces (Data Alliances) can form

https://data-alliance.noaa.gov/

amazon web services

Google Cloud Platform

IBM

Microsoft

OPEN CLOUD CONSORTIUM

Research Objective

- Explore value proposition and self-sustainability of business model by mimicking full market ecosystem via Data Alliances

What does success look like?

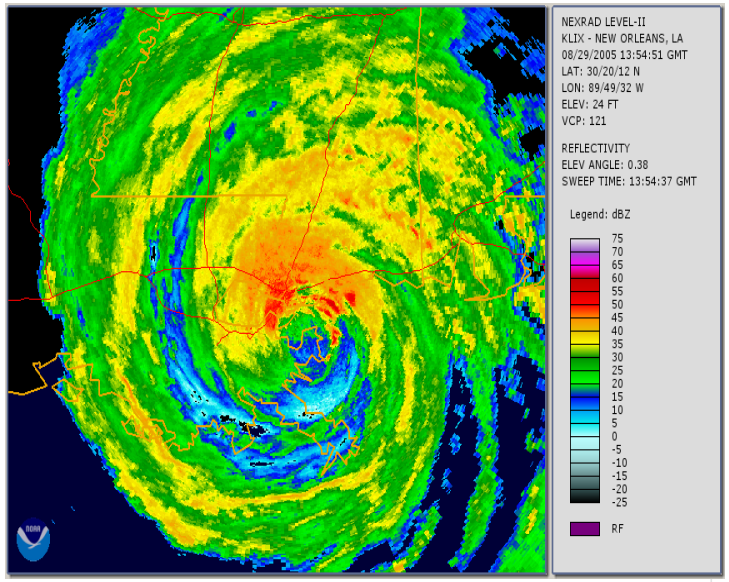
- Demonstrated sustainable use cases of a market ecosystem in one or more Data Alliance

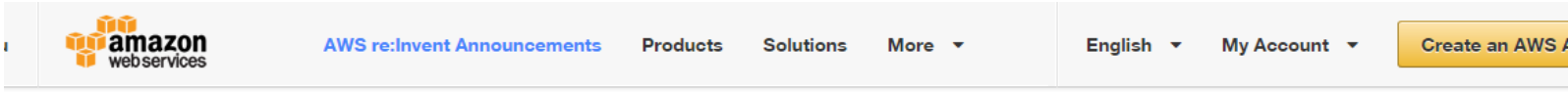
Researching self-sustainable business model mimicking market ecosystem

Central Processing Portfolio

NOAA Big Data Project – Current Activities

- NEXRAD Level II Data
  - Archive and real-time data freely available to public on Amazon Web Services
  - June 1991 - Present (270 TB compressed / 1 PB uncompressed)
  - 180 million files

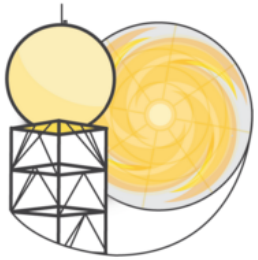




NEXRAD on AWS

The Next Generation Weather Radar (NEXRAD) is a network of 160 high-resolution Doppler radar sites that detects precipitation and atmospheric movement and disseminates data in approximately 5 minute intervals from each site. NEXRAD enables severe storm prediction and is used by researchers and commercial enterprises to study and address the impact of weather across multiple sectors.

The real-time feed and full historical archive of original resolution (Level II) NEXRAD data, from June 1991 to present, is now freely available on Amazon S3 for anyone to use. This is the first time the full NEXRAD Level II archive has been accessible to the public on demand. Now anyone can use the data on-demand in the cloud without worrying about storage costs and download time.



Project Updates

If you would like to show us what you can do with NEXRAD on AWS or would like to receive updates on the project, please fill out the form below.

Researching self-sustainable business model mimicking market ecosystem

Central Processing Portfolio

NOAA Big Data Project – Early Successes

THE CLIMATE CORPORATION

- The Climate Corp (TCC) projects are several weeks shorter
- TCC evaluations of new methods happen on larger datasets

amazon web services™

- TCC no longer pays AWS for S3 bucket to store NEXRAD data
- Instead, TCC pays AWS for EC2 instances to process data

- NOAA data is used more widely without overwhelming NCEI
- TCC and AWS found long-standing problem in NOAA archive, improving data quality

- As class project, undergraduate students created WeatherPipe application to easily process radar data to NetCDF output
- Source code open to community

Researching self-sustainable business model mimicking market ecosystem

Central Processing Portfolio
NWS Open Model Data Initiative

- Survey released in June 2014 for feedback on:
  - additional weather prediction model output needs
  - required format of the data, and
  - how long to make the data available for evaluation purposes
- Results collected in July 2014
  - 7 responses with a total of 18 specific requests received
- Raw list of survey requests presented at NWS Partners meeting in July 2014
- Presented status of requests/actions completed, in-progress, resource constrained, or not possible at NWS Partners meeting in January 2015
- Presented status of list at July 2015 NWS Partners meeting
- Presenting status at January 2016 NWS Partners meeting
  - **One request remaining in progress – all others completed/response provided**

Central Processing Portfolio
NWS Open Model Data Initiative

Completed Responses to Requests

Request	Implementation/Dissemination
Simulated Satellite output from the GFS	FTPPRD, NOAAPORT
Request assimilation of automated commercial aircraft reports in GFS, NAM, SREF	Data assimilated in models
Access to post-processed model grids produced by NCEP Centers – such as OPC, NHC, SPC	NDFD grids are publicly available: http://www.nws.noaa.gov/ndfd/index.htm List of Center-specific products: http://graphical.weather.gov/docs/NDFDelem_complete.xls
Access to model catalog on NCEP produced model data	Available at: http://www.nco.ncep.noaa.gov/pmb/products/
Access to the "Extreme Weather Index" tools currently in experimental mode	The tool is available at: http://ssd.wrh.noaa.gov/satable/

Central Processing Portfolio
NWS Open Model Data Initiative

Completed Responses to Requests

Request	Implementation/Dissemination
Evaluate model output from one month to two years prior to implementation	NCEP used the upcoming GEFS implementation as an experiment to make retrospective model data available publically at http://para.nomads.ncep.noaa.gov/
Provide consistent temporal resolution for GFS after F192	January 2015 GFS implementation provided output 3 hourly from F000 to F240, 12-hrly F240 to F384 on FTPPRD, NOMADS, NOAAPORT
Add BUFR sounding data for The Netherland Schiphol Airport and the Japan Narita Airport	Added with the January 2015 GFS implementation
Customer would like separate meeting with NCO to discuss data sampling and formats	NWS reached out to customers that sent feedback to discuss data sampling and formats. Any additional discussion is welcome.
Increase spatial resolution of GEFS	December 2015 GEFS implementation increased model resolution and increased output to 0.50o resolution for entire model forecast duration

Central Processing Portfolio

NWS Open Model Data Initiative

Responses to Requests in Process as of 1/13/2016

Request	Action	Date to be Resolved	Dissemination Method
Hourly output from the GFS through 8 days	NCEP committed to providing hourly output to 5 days. Planned with the Q3 GFS upgrade, but there is some risk the code balance between I/O and compute may present limitations that put this at risk.	Q3FY16	FTPPRD, NOMADS, NOAAPORT, MAG

Central Processing Portfolio
NWS Open Model Data Initiative

Responses to Requests

Request	Response	Issue with Request
Simulated Radar data from the GFS	No Plans to include in FY15-FY16	Issue is due to the sophistication of the microphysics scheme
Access to GFS in its native resolution	No Plans to provide the Master files	Spectral files in raw format provide significant challenges for ease of use and distribution.
Provide earlier availability times for GFS and GEFS	Times of the model output are based on data input cutoff times	Modifications to model run time severely impacts data assimilation into the model.
Access to commercial airline data assimilated into models	The ACARS data is restricted	NOAA is not allowed to redistribute this data
Access to ATCF model guidance for the global forecast basins	Atlantic, East Pacific, and Central Pacific ATCF guidance available via NHC ftp://ftp.nhc.noaa.gov/atcf	JTWC, part of the U.S. Navy, does not publicly make the guidance available for the Western North Pacific, Northern Indian, and Southern Hemisphere.
Provide ability to customize data requests under a unique login to prevent outside parties knowing which customer accesses certain data types	NWS must ensure equal access to data for all customers.	Violates NWS Policy

Central Processing Portfolio
NWS Open Model Data Initiative

Request: How does one find NCEP Model Data?

- NCEP disseminates data it through various outlets:
  - http://nomads.ncep.noaa.gov - grib filter, http, and OpenDAP options
  - ftp://ftpprd.ncep.noaa.gov – most comprehensive list
  - http://mag.ncep.noaa.gov – graphical model output
  - ftp://tgftp.nws.noaa.gov - includes model and observational data

- Product inventories available at: http://www.nco.ncep.noaa.gov/pmb/products/

- If you still can't find what you need, please contact NCO's Dataflow Group at ncep.list.pmb-dataflow@noaa.gov